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NEW FROGS OF THE GENUS *BATRACHYLODES*
(RANIDAE) FROM THE SOLOMON ISLANDSWalter C. Brown¹ and Fred Parker²

ABSTRACT. Prior to 1963, only two lowland species of the genus *Batrachylodes* (Ranidae) were recognized from the Solomons archipelago. In the past few years intensive sampling of the populations of frogs in the mountain areas of Bougainville has revealed the presence of eight species of this endemic genus. Brief note is also made of their known geographic distribution in the archipelago as well as their zonal distribution in the mountains.

INTRODUCTION

In this paper, the second based on the extensive collections of amphibians obtained by the junior author on Bougainville Island, Solomon Islands, new species of the endemic ranid genus *Batrachylodes* are described.

The genus was set up by Boulenger (1887, p. 337) to accommodate a single species, *vertebralis*. Sternfeld (1921, p. 435) described two frogs from Buka Island which he regarded as microhylids. He named these *Sphenophryne wolfi* and *Chaparina frederici*, each based upon a single specimen. Mertens (1929, p. 266) sank both in the synonymy of *Batrachylodes vertebralis*. Brown and Myers (1949, p. 379) described *B. trossulus* from Bougainville Island.

The collections made by the junior author on Bougainville Island during the period 1961-63 and 1966 contain samples of eight species. Re-examination of the types of *Chaparina frederici* and *Sphenophryne wolfi* confirms the fact that the former is synonymous with *B. vertebralis* (northern Bougainville population). However, our present large series indicates that *B. wolfi* is distinct from

¹ Division of Systematic Biology, Stanford University, and Menlo College, Menlo Park, California; ² Australian Government Service.

B. vertebralis. Thus, three species of this genus have been previously recognized and described. The other five species are new.

All collections previously assigned to *B. vertebralis* from various islands in the Solomons Archipelago should now be re-examined in terms of our present knowledge. Some of these specimens, usually representing very small samples, may actually belong to some other of the large-disked species.

Measurements, determined to the nearest 0.1 mm, with a Helios dial caliper, are based on preserved specimens. Snout-vent length is the distance from the tip of the snout to the vent with the specimen held flat, ventral surface down; the tibia length is the length of the bone of the lower leg; the head length is the distance from the tip of the snout to the posterior edge of the tympanum; head breadth is measured at the angle of the jaws; diameter of the eye is from the anterior to the posterior edge of the socket; first and fourth finger lengths from the tip to the base of the subarticular tubercle; third and second finger lengths from the tip to the base of the second articular tubercle; interorbital distance is breadth of the bone between the eyes. Methods of determining other measurements such as breadth of disks are probably not subject to much variation.

Specimens in the collections of various institutions are identified as follows: Museum of Comparative Zoology, Harvard University (MCZ); Division of Systematic Zoology, Stanford University (SU); British Museum of Natural History (BMNH); Senckenberg Museum, Frankfurt am Main (SMF); and, California Academy of Sciences (CAS).

DESCRIPTIONS OF SPECIES

The genus can, arbitrarily, be conveniently divided into two groups of species: (1) Those with broadly dilated finger disks (except for the inner finger), the breadth of the disk of the third finger is very rarely less than 35 per cent the length of the third finger as measured to the base of the second subarticular tubercle, much more broadly dilated than the largest toe disk; (2) Those species in which the tips of the fingers are not or but moderately dilated, the breadth of the disk of the third finger very rarely more than one-third the length of the third finger, less than to about equal to the breadth of the largest toe disk. The first group, with the exception of *B. vertebralis*, are all relatively large species; the second group are small species.

Small-disked species

Batrachylodes trossulus Brown and Myers

Batrachylodes trossulus Brown and Myers, 1949, Journ. Washington Acad. Sci., 39: 379-80; Torokina, Bougainville I. (type in United States National Museum).

Definition. A small *Batrachylodes*, snout-vent length for 19 mature males ranging from 18.1 to 20.8 mm (Table 1), and for 20 mature females from 18.1 to 22.7 mm (a female 17.3 mm in snout-vent length is immature); tips of fingers scarcely to slightly dilated, ventral part delimited by a circummarginal groove; first finger shorter than second which is slightly shorter than to equal to fourth (Fig. 1); breadth of disk of third finger about 15 to 25 per cent of length of third finger; disks of toes larger than those of fingers, toes with minute webs at base; hindlimbs relatively long, length of tibia about 48 to 55 per cent of snout-vent length; breadth of head about 62 to 73 per cent of length of tibia (Table 2). More than 100 specimens were examined, including MCZ 74824-79.

Color. A blackish band with a smooth dorsal margin extending from the tip of the snout through the eye and ear to the groin or nearly to the groin, becoming narrower on the posterior part of the trunk, under surface of head, throat and usually pectoral region dusky to brown or blackish; dorsum grayish cream to reddish or brownish gray, more or less uniform, or with darker markings, most frequently a small to moderate, dark chevron in the region of the forelimbs.

Distribution. Known from both northern and southern collecting sites of Bougainville Island, as well as the type locality, Torokina, on the central west coast, and possibly Choiseul Island (see Brown and Myers, 1949). It is recorded at elevations from near sea level to about 4000 feet.

Batrachylodes minutus sp. nov.

Holotype. MCZ 41391, an adult female, collected by Fred Parker in the Aresi area, at 2000 feet elevation, on Bougainville Island, Solomon Islands, 14 April 1963.

Paratypes. (all collected by Fred Parker on Bougainville Island) MCZ 41390, from the Aresi area, at 2000 feet elevation, 14 April 1963; MCZ 55534, from Melilup, between 2500 and 3500 feet elevation, collected 14 May 1966; MCZ 55037-49, 55521-28, 55533-40, 55546, 62020-23, SU 23989, 23991-92, from Mutahi, between 2200 and 3500 feet elevation, collected between 9 and

20 May 1966. MCZ 36924 (9 September 1962), MCZ 41386 (25 December 1962), and SU 21852 (30 December 1962), from Pipekei area, between 1000 and 2000 feet elevation.

Diagnosis. A small *Batrachylodes*, measuring about 16 to 19.5 mm in snout-vent length for 20 mature specimens available; disks of fingers not or scarcely dilated (Fig. 2, left), ventral part rather vaguely delimited by a shallow circummarginal groove; first finger usually shorter than but occasionally nearly equal to second, which is equal to or slightly longer than fourth when adpressed; disks of toes larger than those of fingers; toes with minute webs at base; tibia usually less than 48 per cent of snout-vent length; breadth of head about 70 to 78 per cent of length of tibia; without broad, blackish band on lateral surfaces, under surface of head and throat more or less dusky to brown or blackish.

Description. Snout-vent length of 16 mature females 16.7 to 19.3 mm (a female measuring 16.3 is apparently immature judging by the fact that the oviducts are straight and undilated), of seven mature males 15.8 to 17.7 mm (Table 1); hindlimbs moderate, length of tibia ranging from about 43 to 53 per cent of snout-vent length; breadth of head slightly less to slightly greater than length of head, and from 70 to 85 per cent of length of tibia (Table 2); eye moderately large, its diameter slightly less to slightly greater than length of snout, and about 31 to 48 per cent of breadth of head; tympanum distinct, about 50 per cent of diameter of eye; canthus rostralis broadly rounded; loreal region nearly vertical; tongue without notch posteriorly; a fold dorsal and posterior to tympanum; fingers slender, without webs, tips scarcely expanded (Fig. 2); ventral pad rather vaguely delimited by a circummarginal groove, breadth of disk of third finger about 14 to 24 per cent of length of third finger (Table 2); first finger usually shorter than second which is longer than or about equal to fourth when adpressed; hindlimbs moderately long; subarticular tubercles large, elliptical, scarcely protruding; inner and outer metacarpal tubercles relatively large and flattened; length of tibia about 43 to 52 per cent of snout-vent length; toes webbed at base; tips of toes moderately dilated; breadth of disk of third toe about 1.38 to 2.33 times breadth of the disk of third finger; subarticular tubercles large, broadly oval, and not strongly protruding; inner metatarsal tubercle large, broad, reaching nearly to subarticular tubercle of first toe; outer metatarsal tubercle low and round, or scarcely evident.

Color (in preservative). Dorsum variable, ground color light greenish olive, greyish olive, or brownish; sometimes with variable

dark or blackish blotches and flecks, forming an irregular inter-orbital patch and a crude, hourglass pattern, more or less complete, on the dorsum between the forelimbs and the groin; a narrow to moderate, often much interrupted, blackish band from the snout to the region of the tympanum or the forelimbs usually evident; anterior edge of thighs, posterior edge of metatarsal area, and sole of foot also usually marked with a dusky to blackish, irregularly margined band; upper surface of hindlimbs with three more-or-less distinct, broad, dark, transverse bands, blackish, irregular crescent at the anal region; a dusky patch on the posterior surface of the distal part of the thigh and proximal tibia. Under surface of head, throat, and pectoral region heavily marked with dark flecks; abdominal region lighter.

Measurements of type. Snout-vent length 17.6 mm; length of head (to posterior edge of tympanum) 6.2 mm; breadth of head 5.9 mm; diameter of eye 2.5 mm; diameter of tympanum 1.2 mm; length of snout 2.2 mm; length of tibia 8.4 mm; length of third finger to base of proximal subarticular tubercle 2.1 mm; breadth of disk of third finger 0.4 mm; breadth of disk of third toe 0.8 mm.

Distribution. Known from collecting sites on both southern and northern Bougainville Island at altitudes from about 1000 to 3000 feet.

Juveniles. MCZ 41387, a juvenile measuring 8 mm in snout-vent length, is not included in the paratypic series, but is tentatively assigned to this species. In general color pattern, it is less distinct from *B. trossulus* than are the adults with which it was taken.

Comparisons. *B. minutus*, in size and relative lack of dilation of the finger disks, is most similar to *B. trossulus*. It differs in its smaller size at maturity (Table 1); the slightly broader head relative to the snout-vent length, the greater length of the tibia relative to the breadth of the head, the shorter third finger relative to the breadth of the head (Table 2); and noted features of the color pattern, especially the greatly reduced and less conspicuous dark brown to blackish bands on the sides of the head and body.

Batrachylodes mediodiscus sp. nov.

Holotype. MCZ 41589, an adult male, collected by Fred Parker in the Pipekei area, at 2000 feet elevation, on Bougainville Island, Solomon Islands, 29 December 1962.

Paratypes. (all collected by Fred Parker on Bougainville Island) MCZ 44056 (5 August 1963), 41682-83 (13 April 1963), and SU 21812 (1 May 1963), Aresi area, between 600 and 1500

feet; MCZ 38066, 41650, and BMNH 1964-690 (22 January 1963), 38255 (26 February 1963), MCZ 41600-01 (31 December 1962), MCZ 41692-93 (16 April 1963), 41694-95 (1 May 1963), 42295, MCZ 42438 (28 June 1963), MCZ 44148 (28 July 1963), 44162-63 (7 August 1963), 44174-75 (15 September 1963), Kunua area, foothills, between 100 and 1000 feet elevation; MCZ 74101-04, Lake Loloru, between 4000 and 4300 feet elevation, collected 31 March 1963; MCZ 53111, 53124, 53127-29, 53131-34, 53136-38, 53141-45, 53151-53, 53156-57, 53159-66, 53168-74, 53178-94, 53196, 53198-205, 53208-27, 53229-45, 53247-59, 54777-82, 55016-79, 55523-25, 55541-42, 55547, 71082-453, 73272-77, 74105, 74470-722, 74732-823, 76679-80, 79653, Mutahi, between 1800 and 3900 feet elevation, collected between 9 and 20 May 1966; MCZ 55005-6, Pamauita, at 1200 feet elevation, collected 23 March 1966; MCZ 41584-88, 41593, 41599, SU 21814, and SMF 60016, Pipekei, between 2000 and 3200 feet elevation, collected between 29 and 31 December 1962; SU 21815, Pipekei, foothills, 500 feet elevation, collected December 1962; MCZ 55552-53, Topanas, collected 8 May 1966.

Diagnosis. A *Batrachylodes* of moderate size, snout-vent length of mature specimens ranging from about 21 to 25 mm in our present sample (Table 1); disks of fingers and toes usually about equally dilated; breadth of disk of third toe about 90 to 125 per cent of breadth of disk of third finger; breadth of disk of third finger 23 to 34 per cent of length of third finger, and about 35 to 60 per cent of diameter of tympanum.

Description. Snout-vent length of 20 mature females 21.7 to 27.0 mm (a female measuring 20 mm in snout-vent length is immature), of 22 mature males 21.6 to 25.8 mm (Table 1); hindlimbs relatively long, length of tibia ranging from 48 to 57 per cent of snout-vent length for 20 specimens; breadth of head slightly less than to slightly greater than its length and about 66 to 79 per cent of length of tibia; length of snout greater than diameter of eye; eye moderate, its diameter 27 to 39 per cent of breadth of head; tympanum distinct, its diameter about 60 to 70 per cent of diameter of eye; canthus rostralis rounded; loreal region only moderately oblique, not markedly concave; tongue with a shallow notch posteriorly or entire; a low to moderate fold dorsal and posterior to tympanum; fingers moderately slender, without webs, tips expanded into moderate disks; breadth of disk of third finger about 23 to 35 per cent of length of third finger, usually slightly less than breadth of disk of third toe (Table 2), and about 35 to 60 per cent

of diameter of tympanum; ventral pad of finger disks separated from dorsal part by a circummarginal groove; first finger shorter than second which is somewhat shorter than to about equal to the fourth when adpressed; subarticular tubercles moderately large but not strongly protruding; outer metacarpal tubercle round; inner broadly oval; median tubercle large (Fig. 2); tips of toes expanded into moderate disks, usually slightly larger than those of fingers, breadth of disk of third toe 90 to 125 per cent of breadth of disk of third finger for 20 specimens (Table 2); ventral part of disk separated from dorsal part by a circummarginal groove; subarticular tubercles moderate, not strongly protruding; inner metatarsal tubercle narrow, elongate; outer small, round.

Skin of dorsum usually with a few short, narrow, raised folds which are associated with the dark pigmented spots; venter relatively smooth except for the small white tubercles of chin and throat of males; posterior thighs granular.

Color (in preservative). Dorsal ground color variable, ranging from greyish tan, through greyish olive to dark brown; a small blackish spot on either side of the middorsal line in the axillar region, often more elaborate, suggesting a "V" or spread "H," least obvious in the more melanistic individuals; usually a dark blotch or spots on the dorsum at the anterior end of the pelvic girdle; a dusky to black line from the snout posterior to the tympanic region or, at times, continued on the flanks; anterior and posterior thighs and anal region with irregular dusky to blackish markings; two dark transverse bands more or less evident on the thighs; venter uniformly light, or variously mottled with brown, especially on under surface of head and throat.

Measurements of type. Snout-vent length 23.6 mm; length of head to posterior edge of tympanum 9.0 mm; breadth of head 9.1 mm; diameter of eye 3.0 mm; diameter of tympanum 2.1 mm; length of snout 3.5 mm; length of hindlimb 37.0 mm; length of tibia 11.7 mm; length of third finger 3.0 mm; diameter of disk of third finger 0.9 mm; diameter of disk of third toe 1.0 mm.

Distribution. In addition to the large type-series from both northern and southern sites of Bougainville Island, eleven specimens MCZ 41238-43, 41671-72, 55007; and SU 21811, 21813 from Buka Island are referred to this species. The known altitudinal range extends from the coastal plains to about 4000 feet.

Comparisons. *B. mediodiscus* is larger in size at maturity than *B. minutus* or *B. trossulus*, and the disks of the fingers (except the first) are more broadly dilated, being about equal to those of the toes.

Large-disked species

The large-disked species are much less easily distinguished on the basis of conspicuous key-characters than are the small-disked species. In some instances, it is difficult to assign individual specimens, especially juveniles, to a given species, as is in some instances true for other frogs, for example, some species of *Platymantis*. However, such species are frequently distinguishable in the field on the basis of habits, behavior, and/or voice characteristics. Adequate samples may then usually be separated on the basis of a combination of morphological characters. The large-disked species of *Batrachylodes* are such a group. These species include *B. vertebralis* (the type species), *B. wolfi*, and three previously undescribed. These are considered in the following pages.

Batrachylodes wolfi (Sternfeld)

Sphenophryne wolfi Sternfeld, 1921, Abhand. Senckenberg. Naturf. Ges., 36, p. 435: Buka I., Solomon Islands (type in Senckenberg Museum).

Batrachylodes vertebralis (part), Mertens, 1929, Zool. Anz., 80, p. 266.

This is one of the large species of this genus, as measured by snout-vent length at maturity (Table 1). Although individual specimens of this species and *B. vertebralis*, *B. elegans*, or *B. montanus* might be confused, representative samples are readily distinguished on the basis of a combination of several characteristics, as indicated in the comparisons. *Batrachylodes wolfi* is, therefore, resurrected from the synonymy of *Batrachylodes vertebralis*.

Definition. A large *Batrachylodes*, snout-vent length of 20 mature males 25.2 to 30.6 mm, of 24 mature females 28.2 to 31.7 mm (Table 1) (a female measuring 26.5 mm snout-vent is immature, judging by the straight, undilated oviducts); tips of fingers broadly dilated (Fig. 3), much broader than tips of toes, breadth of disk of third finger about 38 to 55 per cent of length of third finger, breadth of disk of first finger 50 to 67 per cent of breadth of disk of third finger; first finger much shorter than second which is about equal to fourth when adpressed (77 to 88 per cent as measured); length of third finger about 35 to 45 per cent of length of head; disks of toes less broadly dilated than those of finger; toes with very minute webs at base; length of tibia usually less than 45 per cent of snout-vent length; head relatively broad, breadth greater than 80 per cent of length of tibia; interorbital breadth about 116 to 150 per cent of length of third finger, and 73 to 92 per cent of length of fourth finger (Table 3). More than 100 specimens were examined, including MCZ 54135-325.

Color. Dorsum greenish (olive green in life), occasionally dark brown for melanistic specimens, generally uniform or nearly so; a moderate, blackish band (in life), its breadth about one-third to one-half the depth of the loreal, extending from the tip of the snout through the eye and the tympanum and remaining more or less uniformly broad until reaching the post-axillary region where it may disappear or fade gradually toward the groin; dark transverse bars on hindlimbs usually absent; venter creamy white in typical color pattern, brownish in melanistic specimens.

Distribution. Presently recorded from both northern and southern sites on Bougainville (elevation from near sea level to about 4000 feet), and from Buka Island.

Comparisons. Based on the Bougainville samples, *B. wolfi* is slightly larger at maturity, both mean and maximum snout-vent length, for both males and females, than *B. vertebralis*, and smaller than *B. elegans*, *B. montanus*, and *B. gigas* (Table 1). *B. wolfi* exhibits less variation in color for the large sample (500+ specimens), and more uniform dorsal coloration of individual specimens than other species of this large-disked group, with the exception of some examples of *B. elegans*. The dorsal ground color of *B. wolfi* is also, except for some melanistic examples, more yellowish or olive green than is characteristic of other species.

The disk of the first finger appears more broadly dilated on the average than the first finger disks of other species, with the exception of *B. gigas*. This is also supported in the ratio of the breadth of the first finger disk to the breadth of the third finger disk (Table 3). The mean ratio of the interorbital distance to the length of the fingers is greater than the mean ratio for the other species, with the exception of the population referred to *B. vertebralis* from northern Bougainville.

For *B. wolfi*, the undersurface of the legs is uniformly light, not flecked or blotched with brown, as in *B. elegans*, and the iris is reddish in life, in contrast to the silver-grey iris of *B. elegans*. *B. wolfi* may be further distinguished from *B. gigas* by the breadth of the finger disks relative to length of fingers, for example, the breadth of the third finger disk to the length of the third finger (Table 3); and from *B. montanus* by the much shorter third finger relative to the length of the head (Table 3).

Batrachylodes vertebralis Boulenger

Batrachylodes vertebralis Boulenger, 1887, Proc. Zool. Soc. London, 1887, p. 337, pl. xxviii, fig. 3; Fauro I., Solomon I. (type in British Museum).

Chaperina frederici Sternfeld, 1921, Abhand. Senckenberg. Naturf. Ges., 36, p. 435; Buka I., Solomon Islands (type in Senckenberg Museum).

Fauro Island, the locality for the unique specimen upon which *B. vertebralis* was based, is located at the southern end of Bougainville Island, from which it is separated by a distance of 9 km or slightly less. A small island lying in the passage divides it into two channels and further reduces the actual overwater distance by nearly half. A sample from the population of this species occurring on southern Bougainville Island is in reasonable agreement with the type, including size at maturity. On the contrary, no individual of a sample of more than 100 specimens from the northeastern part of Bougainville is as large as the type. Boulenger (1887, p. 337) gives the snout-vent length of the holotype, a mature female, as 30 mm; our measurement, using a vernier caliper (see methods), is 28.1 mm. The largest female in our present sample from southern Bougainville is 29.5 mm.

The following definition of the species is based upon a sample of specimens from the southern end of Bougainville, including MCZ 73800-73871.

Definition. A moderate-sized to large *Batrachylodes*, snout-vent length ranges from 25.4 to 29.5 mm for 5 mature females, and 21.4 to 28.6 mm for 18 males (Table 1) (several females between 23.0 and 24.0 mm in snout-vent length are not yet mature, judging by the straight, undilated oviducts); breadth of head 75 to 97 per cent of length of tibia; interorbital breadth 57 to 61 per cent of length of fourth finger, 47 to 54 per cent of length of third finger; tips of fingers, except for the first, broadly dilated (Fig. 3, right), much broader than tips of toes; breadth of disk of third finger about 33 to 43 per cent of length of third finger and 73 to 94 per cent of length of first finger; disk of first finger scarcely dilated, about 40 to 53 per cent of breadth of disk of third finger; first finger much shorter than second, its length being 70 to 80 per cent the length of the latter (as measured); the second slightly shorter than or equal to fourth when adpressed; disks of toes much less broadly dilated than those of fingers; breadth of disk of third toe 71 to 87 per cent of breadth of disk of second finger; toes with minute webs at base; length of tibia 43 to 52 per cent of snout-vent length; head breadth usually less than 80 per cent of length of tibia (Table 3).

Color. Dorsum grayish cream to tan to brownish, darker markings in various patterns, occasionally with a light vertebral strip; a dark line or narrow band with irregular dorsal margins or a series

of blotches from the tip of the snout through the eye and the dorsal part of the tympanum, with a deep indentation anterior to the forelimbs, dark transverse bands of the hindlimbs; usually brownish mottled, at least anteriorly.

Variation. The sample of the population from northern Bougainville which is referred to *B. vertebralis* differs from the sample of population of southern Bougainville in a number of characteristics: the generally smaller size at maturity for both males and females (Table 1); the greater frequency of lighter shades of color (grayish) in the dorsal ground color; and, the somewhat broader interorbital relative to length of the fingers, length of head, and length of snout (Table 4). The call, as observed in the field, appears identical. The noted differences are sufficiently great that these two populations may well prove to be distinct subspecies. However, since we do not have information regarding the characteristics of samples from the more central areas of Bougainville, we have chosen, for the present, to hold in abeyance a decision as to the taxonomic importance of the observed differences.

Distribution. *B. vertebralis* is recorded from numerous islands throughout the archipelago (Brown, 1952), but in view of the number of morphologically similar species which are now known, the collections upon which the records are based should be re-determined. The population in southern Bougainville ranges from sea level to about 4000 feet; the population on northern Bougainville ranges from sea level to about 3000 or 3500 feet.

Comparisons. Differences in size relative to the other large-disked species and several characteristics which distinguish *B. vertebralis* from *B. wolfi* have been noted in the previous section. *B. vertebralis* may be further distinguished: from *B. gigas* on the basis of the smaller third toe disk relative to breadth of the disk of second or third fingers; from *B. montanus* by the greater breadth of interorbital relative to the breadth of the disk of third finger and the larger tympanum relative to the third finger disk; and, from *B. elegans* by the usually smaller tympanum relative to the third finger disk (Tables 3 and 4).

Batrachylodes gigas sp. nov.

Holotype. MCZ 73764, an adult female, collected by Fred Parker in the Lake Loloru area, at 4300 feet elevation, on Bougainville Island, Solomon Islands, 31 March 1966.

Paratypes. (all collected by Fred Parker on Bougainville Island) MCZ 62018-19, 73765, and CAS 117442 from Lake Loloru, 4300 feet elevation, collected 31 March 1966.

Diagnosis. A large *Batrachylodes*, snout-vent length of 42.5 to 46 mm for three mature females (Table 1); breadth of disk of first finger usually more than 50 per cent of breadth of disk of third finger; breadth of disk of third finger less than 40 per cent of length of third finger, 65 to 75 per cent of the length of first finger, and 55 to 75 per cent of interorbital breadth; breadth of disk of third toe about 90 to 95 per cent of the breadth of disk of second finger and 65 to 85 of breadth of disk of third finger; diameter of tympanum about 80 to 110 per cent of breadth of disk of third finger; interorbital distance relatively narrow, about 95 to 100 per cent of length of first finger, 30 to 40 per cent of length of third finger and 20 to 22 per cent of length of head; first finger shorter than second, which is much shorter than fourth when adpressed; and, an irregularly margined dark or blackish band or blotches on anterior thigh, inner surface of tibia, and lower surface of tarsus.

Description. Snout-vent length of three mature females 42.7 to 46 mm (two females 34 mm in snout-vent length are immature, as judged by the straight, undilated oviducts); hindlimbs moderately long, length of tibia 44 to 52 per cent of snout-vent length for five specimens; breadth of head slightly less than to slightly greater than its length, and about 80 to 97 per cent of length of tibia; eye moderate, diameter of the eye about 80 to 100 per cent of length of snout; tympanum distinct, its diameter about 46 to 55 per cent of diameter of eye; interorbital distance about 20 to 22 per cent of head length, less than 55 per cent of length of third finger, and usually slightly less than length of first finger (Table 3); canthus rostralis rounded; loreal region moderately oblique, only slightly concave; tongue entire, truncate posteriorly or with a minute notch posteriorly; a fold dorsal and posterior to the tympanum; fingers without webs, the tips broadly dilated except for that of first; breadth of disk of first finger about 50 to 62 per cent of breadth of disk of third finger; breadth of disk of third finger about 31 to 39 per cent of length of third finger; and about 80 to 110 per cent of diameter of tympanum; ventral pad of disks separated from dorsal part by a circummarginal groove; first finger shorter than second, which is shorter than fourth when adpressed; subarticular tubercles moderately large but not strongly protruding; inner metacarpal tubercle small, low, and rounded; middle one broadly oval; outer one elongate (Fig. 1); tips of toes expanded into moderate disks,

smaller than those of fingers, breadth of disk of third toe about 65 to 85 per cent of breadth of disk of third finger, and 90 to 95 per cent of breadth of disk of second finger (Table 3); ventral part of disk separated from dorsal part by a circummarginal groove; sub-articular tubercles moderately large, rather low; inner metatarsal tubercle elongate, oval; outer small, round; toes with a very shallow web at the base, except between the first and second.

Skin of dorsum and venter smooth; posterior surface of thighs with low, flattish granules.

Color (in preservative). Dorsum variable, from light grayish olive or light brownish olive to salmon red; a dark interorbital bar and a dark "W" just posterior to the head are usually distinct; lateral surface of head through eye and tympanum and upper lateral surface of anterior part of body marked by a blackish band which tapers and fades posteriorly; lower lateral surfaces and anterior part of venter or entire venter densely marked by dark flecks; posterior surface of lower arm and both anterior and posterior surface of thighs with irregularly margined dark longitudinal bands; moderate, dark, transverse bands on hindlimbs may be strongly or only faintly marked.

Measurements of type. Snout-vent length 46.0 mm; length of head to posterior edge of tympanum 16.6 mm; breadth of head 17.6 mm; diameter of eye 5.5 mm; diameter of tympanum 2.6 mm; length of snout 6.7 mm; interorbital distance 3.75 mm; length of hindlimb 69.4 mm; length of tibia 24.0 mm; length of third finger 7.1 mm; diameter of disk of third finger 2.8 mm; diameter of disk of third toe 1.9 mm; length of first finger 3.75 mm; first finger disk 1.55 mm; length of second finger 4.55 mm; second finger disk 2.2 mm; length of fourth finger 6.3 mm; fourth finger disk 2.55 mm.

Distribution. Known only from the type locality in the mountains near Lake Loloru area at the southern end of Bougainville Island at altitudes of about 4000 to 5000 feet.

Comparisons. This is the largest known member of the genus. The smallest of the three mature females (preserved state) measures 42.7 mm and the largest 46 mm in snout-vent length. Males of this species are unknown. As compared to the other three broad-disked species, the disks of the fingers are slightly less dilated; the breadth of the disk of the third finger is less than 75 per cent of the length of the first finger (usually greater than 80 per cent for the other large-disked species), and less than 40 per cent of the length of the third finger length (usually greater than 40 per cent for the rest of the species other than *vertebralis* from the

southern part of Bougainville). The disk of the third toe is almost as large as the disk of the second finger – 90 to 95 per cent (usually less than 90 per cent for the other large-disked species). The interorbital distance relative to the length of the fingers is usually less than for other large-disked species with the exception of *B. montanus*. The breadth of the disk of the first finger is about 50 to 60 per cent of the breadth of the disk of the third finger. In this ratio *gigas* resembles *wolffi*, whereas the other large-disked species usually show this ratio as less than 50 per cent.

Batrachylodes elegans sp. nov.

Holotype. MCZ 54559, an adult female, collected by Fred Parker at Mutahi, between 2200 and 3200 feet elevation, on Bougainville Island, Solomon Islands, 16 May 1966.

Paratypes. (all collected by Fred Parker on Bougainville Island) MCZ 54333, 54337, 54339, 54341, 54345-47, 54353, 54358, 54361, 54363, 54365-66, 54514-58, 54560-65, 54615-758, 55186-89, 73298-385, 73519-644, 78822, 79075-461, 79654-79, and CAS 117444-65, from Mutahi, between 1800 and 3600 feet elevation, collected between 10 and 20 May 1966; MCZ 54566-67, 54569-72, 54574-75, 54577-80, 54582, 54584-94, 54596-614, 55190-94, 73633-41, from Melilup, between 3000 and 4000 feet elevation, collected between 12 and 20 May 1966; MCZ 55195-6 from Ramazon River at Melilup, 19 May 1966.

Diagnosis. A moderately large *Batrachylodes*, snout-vent length of mature males measuring about 25 to 32 mm and of mature females 26 to 35 mm (Table 1); dorsal ground color relatively uniform brownish or variously patterned, a dark brownish, dorsally even-margined lateral band on the side of the head, narrowing on the flanks; ratio of interorbital breadth to length of first finger about 1.2 to 1.6, to length of third finger about 0.53 to 0.76, and to length of fourth finger 0.61 to 0.77; disk of first finger scarcely dilated, its diameter 41 to 52 per cent of diameter of third finger disk; diameter of third finger disk usually greater than diameter of tympanum (94 to 130 per cent); diameter of third toe disk 79 to 100 per cent of diameter of second finger disk and 61 to 81 per cent of diameter of third finger disk.

Description. Snout-vent length of 24 females 26.7 to 34.6 mm, of 30 males 24.8 to 32.0 mm (however, several females between 26 and 28 mm in snout-vent are immature, as judged by the straight, undilated oviducts); hindlimbs moderately long, the length of the tibia about 42 to 50 per cent of the snout-vent length;

breadth of head slightly less to slightly greater than length of head, 74 to 87 per cent of length of tibia; eye moderate, its diameter less than length of snout; tympanum distinct, its diameter 49 to 55 per cent of diameter of eye and 94 to 120 per cent of breadth of disk of third finger (Table 3); canthus rostralis rounded; loreal region moderately oblique, slightly concave; tongue with a shallow-rounded or v-shaped notch posteriorly; a low, moderate fold dorsal and posterior to tympanum; fingers without webs; tips of fingers, except for first finger, broadly dilated (the dilation of the disks and the relative lengths of the finger do not differ greatly from the condition exhibited by *B. vertebralis*; Fig. 3, right); diameter of disk of third finger 38 to 48 per cent of length of third finger, ventral pad of disks separated from the dorsal part by a circummarginal groove; first finger shorter than the second which is somewhat shorter than the fourth when adpressed (71 to 84 per cent as measured); subarticular tubercles moderate, oval to round, not strongly protruding; inner metacarpal tubercle large, longer than broad; outer metacarpal tubercle similar but smaller; median tubercle large, oval; toes webbed at base; tips of toes expanded into moderate disks; diameter of disk of third toe about 80 to 100 per cent of diameter of disk of second finger, 61 to 81 per cent of diameter of disk of third finger (Table 3); ventral part of disk separated from dorsal part by a circummarginal groove; subarticular tubercles moderate in size, somewhat more protruding than those of fingers; inner metatarsal tubercle elongate, narrow, oval; outer one round; solar area smooth.

Skin of dorsum and belly is smooth. The posterior thighs are marked by a pattern of low, flattish granules.

Color (in preservative). Dorsal ground color grayish to dark brown, relatively uniform or with varied pattern of lighter or darker markings; a dark brown band with relatively smooth dorsal margin extending from the snout through the eye and tympanum and posteriorly on to the flank. This band usually covers the entire loreal region. Many specimens exhibit a whitish line or series of white spots along the upper margin of the dark, lateral band and variable white spotting of the limbs and dorsum. The undersurface of the hindlimbs and the anterior venter are lightly or heavily speckled with brown.

Measurements of type. Snout-vent length 34 mm; length of head 12.2 mm; breadth of head 13.1 mm; diameter of eye 4.2 mm; diameter of tympanum 2.2 mm; length of snout 4.8 mm; length of hindlimb 51.7 mm; length of tibia 15.8 mm; length of third finger

5.6 mm; diameter of disk of third finger 2.25 mm; diameter of disk of third toe 1.5 mm.

Distribution. Known from the mountains of northern Bougainville Island at elevations from 2000 to 4000 feet.

Comparisons. In size at maturity *B. elegans* is only slightly larger than *B. wolfi*, on the average, and females somewhat smaller than those of *B. montanus*. Other characteristics which distinguish *B. elegans* from *B. vertebralis*, *B. wolfi*, and *B. gigas* have been discussed in previous sections. *B. elegans* is further differentiated from *B. montanus* by the greater breadth of the interorbital relative to the length of the fingers; the larger tympanum relative to the breadth of the third finger disk, and the greater breadth of the third toe disk relative to the breadth of the second or third finger disks.

Batrachylodes montanus sp. nov.

Holotype. MCZ 55009, an adult female, collected by Fred Parker at Melilup, between 3500 and 4000 feet elevation, on Bougainville Island, Solomon Islands, 19 May 1966.

Paratypes. (all collected by Fred Parker on Bougainville Island) MCZ 55010 (31 May 1966), 73762-3 (31 March 1966), from Lake Loloru, between 4000 and 4300 feet elevation; MCZ 55011, 55013-15, from Melilup, between 3500 and 4000 feet elevation, collected 19 May 1966; MCZ 55529-32, and CAS 117443, from Mutahi, between 3000 and 3600 feet elevation, collected 18 May 1966.

Diagnosis. A large *Batrachylodes*, snout-vent length of mature males ranging from about 27 to 35 mm, of mature females 39 to about 40 mm for the limited sample available (Table 1); diameter of tympanum less than (70 to 91 per cent) breadth of third finger disk; disks of fingers, except for first finger, much more broadly dilated than those of toes, breadth of disk of third toe about 48 to 67 per cent of breadth of disk of third finger, and about 60 to 80 per cent of breadth of disk of second finger; breadth of disk of first finger usually less than 50 per cent of breadth of disk of third finger; interorbital breadth about 40 to 50 per cent of length of third finger, 50 to 60 per cent of length of fourth finger, and 90 to 110 per cent of length of first finger, breadth of disk of third finger about 70 to 100 per cent of interorbital breadth (Table 3); dorsal ground color gray to brown; brownish band on side of head narrow, irregularly margined or broken, usually not extending posterior to the forelimbs.

Description. Snout-vent length of five mature females 38.2 to 39.4 mm, and eight mature males 26.7 to 35 mm (a female measuring 29.4 mm in snout-vent length is immature); hindlimb moderate, length of the tibia from 42 to 47 per cent of the snout-vent length; breadth of head usually slightly greater than length of head, and about 81 to 100 per cent of length of tibia; eye moderate, its diameter 28 to 35 per cent of breadth of head, about equal to or somewhat less than length of snout; tympanum distinct, its diameter about one-third to one-half diameter of eye and 69 to 91 per cent of diameter of disk of third finger (Table 3); canthus rostralis broadly rounded; loreal region moderately oblique, not or but slightly concave; a low fold may or may not be evident dorsal and posterior to the tympanum; fingers without webs; tips, except for first finger, broadly dilated (the dilation of the disks and the relative lengths of the fingers do not differ markedly from the condition exhibited by *B. vertebralis*; see Fig. 3, right); breadth of disk of third finger about 35 to 43 per cent of its length, about 70 to 100 per cent of interorbital breadth and 80 to 97 per cent of length of first finger (Table 3); ventral pad of finger disks separated from dorsal part by a circummarginal groove; first finger shorter than second, which is shorter than fourth when adpressed (about 71 to 81 per cent, as measured); subarticular tubercles moderate, low; inner and middle metacarpal tubercles broadly oval; outer ones narrow elongate; hindlimbs moderately long; toes with minute webs at base; tips of toes dilated into moderate disks; diameter of disk of third toe about 60 to 80 per cent of diameter of second finger disk and about 48 to 67 per cent of diameter of third finger disk (Table 3); ventral part of disk separated from dorsal part by a circummarginal groove; subarticular tubercles moderate, rounded, not strongly protruding; inner metatarsal tubercle large, about twice as long as broad; outer small, round.

Skin of dorsum and venter smooth; posterior surface of thighs with low, rather inconspicuous granules.

Color (in preservative). Dorsal ground color grayish tan to brown, mottled, or frequently with a long, dark hourglass marking or dark chevron in region of forelimbs, along with dark blotches posteriorly; the dark band on the side of the head is narrow, irregularly margined, terminating at the tympanic region, or fading gradually on the flanks; venter marked by scattered, small dark flecks.

Measurements of type. Snout-vent length 38.6 mm; length of head 13.6 mm; breadth of head 14.6 mm; diameter of eye 4.6 mm; length of snout 5.2 mm; interorbital breadth 3.2 mm; diameter of

tympanum 2.1 mm; length of hindlimb 58.3 mm; length of tibia 17.7 mm; length of third finger 7.3 mm; diameter of disk of third finger 2.6 mm; diameter of disk of third toe 1.6 mm.

Distribution. Known from higher elevations; about 3000 to 4000 feet in the mountains at the northern and southern ends of Bougainville Island.

Comparisons. Females of *B. montanus*, based on our limited sample, apparently attain larger size at maturity than any of the other species with the exception of *B. gigas*. It differs from *B. wolfi*, *B. gigas*, and *B. elegans* in some features of color pattern (see those species). It may be distinguished from *B. elegans*, *B. vertebralis*, and *B. wolfi* in the greater length of the fingers relative to the interorbital distance, and the smaller tympanum relative to the breadth of the third finger disk. This species also differs from *B. gigas* in the greater breadth of the third toe disk relative to the breadth of the second or third finger disks.

Distributional Pattern

The genus *Batrachylodes* is widely distributed in the Solomons Archipelago, from Buka Island in the north to Santa Ana Island in the south, but surprisingly is unknown from New Ireland, the southernmost island in the Bismarks, about 100 miles from Buka, and is thus apparently endemic to the Solomons.

The evidence as to altitudinal distribution of the genus on the large, northern island of Bougainville, obtained in the present study, indicates that the two large species, *B. gigas* and *B. montanus*, occur only above 3000 feet, the approximate lower limit of the submontane rainforest. *B. elegans* has a somewhat broader montane range, being recorded from elevations as low as about 2000 feet. *B. minutus* has been recorded only from elevations between 1000 and 3000 feet. The species *B. wolfi* and *B. trossulus* have been recorded from sea level to about 4000 feet, as has *B. vertebralis* in southern Bougainville Island. The population of *vertebralis* from the north end of Bougainville is apparently limited to elevations below 3000 to 3500 feet. Also, it should be noted that *B. gigas* is known only from the mountains at the southern end of Bougainville, and *B. elegans* is known only from the mountains at the north end. This interesting distributional pattern for the genus on Bougainville suggests that thorough exploration of the mountain habitats of other of the Solomons islands may well discover other isolated, montane species.

KEY TO THE SPECIES OF *BATRACHYLODES* IN THE SOLOMON ISLANDS

As previously noted, the several large-disked species of this genus, though readily distinguished in the field on the basis of voice characteristics and at times living-color features which disappear in preservative, do not lend themselves to ready identification of individuals by means of a typical dichotomous key. It is hoped, however, that the following key, based on a combination of characters amounting almost to a diagnosis, may serve to distinguish even small samples of adult individuals. Differences in characteristics of juveniles are not yet clear.

1. Tips of fingers only slightly to moderately dilated; breadth of disk of third toe usually greater than to about equal to breadth of disk of third finger; breadth of disk of third finger usually less than 30 per cent (occasionally about one-third) the length of third finger 2
 Tips of fingers moderately to broadly dilated; breadth of disk of third toe usually less than 75 per cent (rarely up to 85 per cent) of breadth of disk of third finger; breadth of disk of third finger greater than 30 per cent of length of third finger 4
2. Size at maturity about 21 to 27 mm in snout-vent length (60 specimens); breadth of disk of third toe about 90 to 125 per cent of breadth of disk of third finger*B. mediodiscus*
 Size at maturity about 15 to 23 mm in snout-vent length (62 specimens); breadth of disk of third toe about 140 to 180 per cent of breadth of disk of third finger 3
3. Size at maturity 15.8 to 19.3 mm in snout-vent length (22 specimens); breadth of head more than 70 per cent of tibia length (Table 2); lateral surfaces without extensive dark band from tip of snout to near groin and on outer surface of thigh (if present, much reduced), usually with broad, dark, transverse bands on hindlimbs*B. minutus*
 Size at maturity 18.1 to 22.7 mm in snout-vent length (40 specimens); breadth of head rarely more than 70 (usually about 65) per cent of tibia length (Table 2); lateral surfaces with prominent blackish band from tip of snout to near groin and on outer surface of thigh; dark, transverse bands on hindlimbs lacking or very faint*B. trossulus*
4. Mature females attaining more than 40 mm in snout-vent length; breadth of disk of third finger about 30 to 40 per cent of length of third finger and usually less than 75 per cent of

- length of first finger; interorbital distance about 95 to 100 per cent of length of first finger; uneven-margined, blackish band or large blotches on anterior thigh, inner surface of tibia and under surface of tarsus *B. gigas*
 Mature females not attaining more than 40 mm in snout-vent length; breadth of disk of third finger 35 to 55 per cent of length of third finger and usually more than 75 per cent of length of first finger; blackish bands absent from anterior thigh, inner surface of tibia, and under surface of tarsus 5
5. Snout-vent length of mature females between 30 to 40 mm; interorbital distance less than 60 per cent of length of fourth finger and 90 to 110 per cent of length of first finger; tympanum usually less than 90 per cent of breadth of third finger disk; breadth of third toe disk 48 to 65 per cent of breadth of third finger disk *B. montanus*
 Snout-vent length of mature females between 24 and 35 mm; interorbital distance usually greater than 60 per cent of length of fourth finger, and usually greater than 110 per cent of length of first finger; breadth of third toe disk 55 to 85 per cent of breadth of third finger disk 6
6. Snout-vent length of 40 mature males about 21 to 28 mm, of 30 mature females 24 to 29 mm; dark band on side of head usually confined to upper loreal region, rather uneven-margined dorsally, terminating at point anterior to forelimbs or, if extending on to the flank, usually with a break or deep indentation just anterior to the forelimb; breadth of head about 70 to 80 per cent of length of tibia (only for population from northern Bougainville Island); interorbital breadth less than 60 per cent of length of third finger, and usually less than 120 per cent of length of first finger (only for population from northern Bougainville Island) *B. vertebralis*
 Snout-vent length of 50 mature males 25 to 32 mm, of 44 mature females 27 to 32 mm; dark band on side of head usually even-margined dorsally (often covering most of loreal region for *B. elegans*), and usually without break or indentation anterior to forelimb; breadth of head about 75 to 95 per cent of length of tibia; interorbital breadth usually greater than 60 per cent of length of third finger and usually greater than 130 per cent of length of first finger 7
7. Dorsal ground color greenish to olive (dark brown in melanistic individuals), relatively uniform; lateral band blackish (at least in life); interorbital distance 73 to 92 per cent of length

of fourth finger length of first finger 55 to 67 per cent of length of fourth finger; disk of first finger distinctly dilated and breadth of its disk usually greater than 50 per cent of breadth of third finger disk *B. wolfi*
 Dorsal ground color tan or brown, variously marked with darker or lighter patterns; lateral band dark brown; interorbital distance about 60 to 77 per cent of length of fourth finger; length of first finger 48 to 60 per cent of length of fourth finger; disk of first finger scarcely dilated and breadth of its disk usually less than 50 per cent of breadth of third finger disk *B. elegans*

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LITERATURE CITED

- BOULENGER, G. A.
 1887. Second contribution to the herpetology of the Solomon Islands. Proc. Zool. Soc. London, **1887**: 333-338, pl. xxvii.
- BROWN, WALTER C.
 1952. Amphibians of the Solomon Islands. Bull. Mus. Comp. Zool., **107**: 1-64, pls. 1-8.
- BROWN, WALTER C., AND MYERS, GEORGE S.
 1949. A new frog of the genus *Batrachylodes* from the Solomon Islands. Jour. Washington Acad. Sci., **39**(11): 379-380.
- MERTENS, ROBERT.
 1929. Zur Synonymie der Froschgattung *Batrachylodes* Boulenger. Zool. Anz., **80**: 266-268.
- STERNFELD, R.
 1921. Zur Tiergeographie Papuasien und der pazifischen Inselwelt. Abhand. Senckenberg. Naturf. Ges., **36**: 375-436, pl. xxxi.

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TABLE 1

Size at maturity of the species of *Batrachylodes*
known from the Solomon Islands
(R=range, M=mean, N=number)

	Snout-vent length at maturity	
	Male	Female
<i>Batrachylodes minutus</i>	R=15.8-17.7 M=16.9 N=6	R=16.7-19.3 M=17.8 N=16
<i>Batrachylodes trossulus</i>	R=18.1-20.8 M=19.4 N=20	R=18.1-22.7 M=20.7 N=20
<i>Batrachylodes mediodiscus</i>	R=21.6-25.8 M=23.7 N=22	R=21.7-27.0 M=24.2 N=20
<i>Batrachylodes wolffi</i>	R=25.2-30.6 M=27.7 N=20	R=28.2-31.9 M=29.9 N=20
<i>Batrachylodes vertebralis</i> (north end of Bougainville)	R=21.6-26.7 M=24.3 N=22	R=24.1-27.6 M=26.06 N=20
<i>Batrachylodes vertebralis</i> (south end of Bougainville)	R=21.4-28.6 M=26.08 N=18	R=25.4-29.5 M=27.36 N=5
<i>Batrachylodes elegans</i>	R=24.8-32.4 M=29.1 N=30	R=26.7-34.6 M=30.5 N=24
<i>Batrachylodes gigas</i>	R= M= N=	R=42.7-46.0 M=44.47 N=3
<i>Batrachylodes montanus</i>	R=26.7-35.4 M=32.6 N=8	R=38.2-39.4 M=38.6 N=5

TABLE 2

Pertinent proportional differences for species of *Batrachylodes* with small finger disks (R=range, M=mean, N=number)

	$\frac{\text{Breadth of disk of 3rd finger}}{\text{Length of 3rd finger}}$	$\frac{\text{Breadth of disk of 3rd toe}}{\text{Breadth of disk of 3rd finger}}$	$\frac{\text{Length of 3rd finger}}{\text{Breadth of head}}$	$\frac{\text{Breadth of head}}{\text{Length of tibia}}$
<i>Batrachylodes minutus</i>	R=0.143-0.238 M=0.198 N=16	R=1.38-2.33 M=1.83 N=16	R=0.318-0.380 M=0.348 N=16	R=0.697-0.855 M=0.763 N=20
<i>Batrachylodes trossulus</i>	R=0.143-0.240 M=0.188 N=20	R=1.42-2.28 M=1.79 N=20	R=0.340-0.452 M=0.397 N=20	R=0.618-0.725 M=0.654 N=20
<i>Batrachylodes mediodiscus</i>	R=0.231-0.345 M=0.292 N=20	R=0.900-1.25 M=1.07 N=20	R=0.299-0.372 M=0.325 N=20	R=0.664-0.791 M=0.742 N=20

TABLE 3
Pertinent proportional differences for samples of *Batrachylodes*
with larger finger disks (R=range, M=mean, N=number)

	<i>Batrachylodes</i> <i>wolffi</i>	<i>Batrachylodes</i> <i>elegans</i>	<i>Batrachylodes</i> <i>gigas</i>	<i>Batrachylodes</i> <i>vertebralis</i> (south end of Bougainville)	<i>Batrachylodes</i> <i>montanus</i>
Breadth of disk of 3rd toe	R=0.722-1.00 M=0.861 N=20	R=0.789-1.00 M=0.888 N=20	R=0.909-0.950 M=0.933 N=5	R=0.714-0.869 M=0.780 N=20	R=0.595-0.800 M=0.716 N=10
Breadth of disk of 2nd finger	R=0.650-0.867 M=0.710 N=20	R=0.611-0.812 M=0.704 N=20	R=0.714-0.833 M=0.773 N=5	R=0.555-0.742 M=0.659 N=20	R=0.482-0.646 M=0.561 N=12
Breadth of disk of 3rd toe	R=0.517-0.833 M=0.660 N=20	R=0.583-0.772 M=0.664 N=20	R=0.582-0.747 M=0.670 N=20	R=0.640-0.860 M=0.720 N=20	R=0.696-1.00 M=0.827 N=13
Breadth of disk of 3rd finger					
Interorbital breadth					

Interorbital breadth	R=0.579-0.725 M=0.654 N=20	R=0.529-0.762 M=0.641 N=20	R=0.474-0.539 M=0.511 N=5	R=0.489-0.574 M=0.528 N=20	R=0.429-0.565 M=0.482 N=13
Length of 3rd finger					
Interorbital breadth	R=1.16-1.50 M=1.34 N=20	R=1.16-1.59 M=1.40 N=20	R=0.946-1.02 M=0.981 N=5	R=1.07-1.25 M=1.16 N=20	R=0.900-1.12 M=1.02 N=13
Length of 1st finger					
Interorbital breadth	R=0.732-0.915 M=0.803 N=20	R=0.616-0.773 M=0.681 N=20	R=0.574-0.611 M=0.586 N=5	R=0.577-0.689 M=0.625 N=20	R=0.484-0.632 M=0.556 N=12
Length of 4th finger					
Diameter of tympanum	R=0.706-1.20 M=0.905 N=20	R=0.939-1.20 M=1.05 N=20	R=0.833-1.11 M=0.963 N=5	R=0.811-1.24 M=0.947 N=20	R=0.692-0.913 M=0.778 N=11
Breadth of disk of 3rd finger					
Diameter of eye	R=0.306-0.385 M=0.339 N=20	R=0.308-0.376 M=0.334 N=20	R=0.298-0.347 M=0.323 N=5	R=0.330-0.396 M=0.365 N=20	R=0.289-0.378 M=0.336 N=12
Breadth of head					

TABLE 3 — (continued)

	<i>Batrachylodes</i> <i>wolffi</i>	<i>Batrachylodes</i> <i>elegans</i>	<i>Batrachylodes</i> <i>gigas</i>	<i>Batrachylodes</i> <i>vertebralis</i> (south end of Bougainville)	<i>Batrachylodes</i> <i>montanus</i>
Length of 2nd finger	R=0.771-0.882 M=0.824 N=20	R=0.718-0.842 M=0.782 N=20	R=0.683-0.766 M=0.717 N=5	R=0.706-0.831 M=0.753 N=20	R=0.710-0.811 M=0.758 N=12
Length of 4th finger					
Breadth of disk of 3rd finger	R=0.750-1.04 M=0.878 N=20	R=0.750-1.05 M=0.922 N=20	R=0.648-0.747 M=0.658 N=5	R=0.737-0.944 M=0.825 N=20	R=0.786-0.968 M=0.870 N=12
Length of 1st finger					
Breadth of disk of 1st finger	R=0.500-0.611 M=0.561 N=20	R=0.417-0.526 M=0.468 N=20	R=0.500-0.625 M=0.568 N=20	R=0.424-0.533 M=0.470 N=20	R=0.407-0.526 M=0.466 N=12
Breadth of disk of 3rd finger					
Breadth of disk of 3rd finger	R=0.368-0.546 M=0.415 N=20	R=0.341-0.476 M=0.418 N=20	R=0.316-0.394 M=0.347 N=5	R=0.340-0.411 M=0.380 N=20	R=0.356-0.435 M=0.398 N=13
Length of 3rd finger					

Length of 3rd finger	R=0.355-0.446 M=0.397 N=20	R=0.379-0.435 M=0.403 N=20	R=0.414-0.461 M=0.431 N=5	R=0.390-0.472 M=0.435 N=20	R=0.423-0.537 M=0.492 N=12
Head length					
Length of tibia					
Snout-vent Length	R=0.375-0.468 M=0.426 N=20	R=0.420-0.508 M=0.466 N=20	R=0.444-0.522 M=0.481 N=20	R=0.400-0.488 M=0.465 N=20	R=0.424-0.489 M=0.449 N=12
Breadth of head	R=0.328-0.399 M=0.378 N=20	R=0.334-0.404 M=0.375 N=20	R=0.364-0.415 M=0.389 N=5	R=0.356-0.397 M=0.369 N=20	R=0.362-0.416 M=0.385 N=12
Snout-vent length					
Breadth of head	R=0.825-0.947 M=0.873 N=20	R=0.740-0.868 M=0.806 N=20	R=0.733-0.889 M=0.807 N=5	R=0.741-0.894 M=0.831 N=20	R=0.788-0.975 M=0.862 N=12
Length of tibia					

TABLE 4
Proportional differences for samples of *B. vertebralis*
from the northern and southern ends of Bougainville Island
(R=range, M=mean, N=number)

	Interorbital breadth	Diameter of eye	Interorbital breadth	Length of 3rd finger	Interorbital breadth	Length of 4th finger	Length of 1st finger	Length of 4th finger	Length of 1st finger	Length of 3rd finger	Interorbital breadth	Snout length	Interorbital breadth	Length of breadth of head
<i>Batrachylodes</i> <i>vertebralis</i> (north end of Bougainville)	R=0.682-0.897 M=0.788 N=20		0.542-0.743 0.651 20	0.577-0.689 0.625 20	0.533-0.704 0.610 20	0.444-0.543 0.498 20	0.637-0.867 0.746 20	0.247-0.314 0.285 20						
<i>Batrachylodes</i> <i>vertebralis</i> (south end of Bougainville)	R=0.568-0.697 M=0.627 N=20		0.489-0.574 0.528 20	0.577-0.689 0.625 20	0.487-0.595 0.547 20	0.404-0.489 0.455 20	0.535-0.667 0.603 20	0.205-0.249 0.231 20						

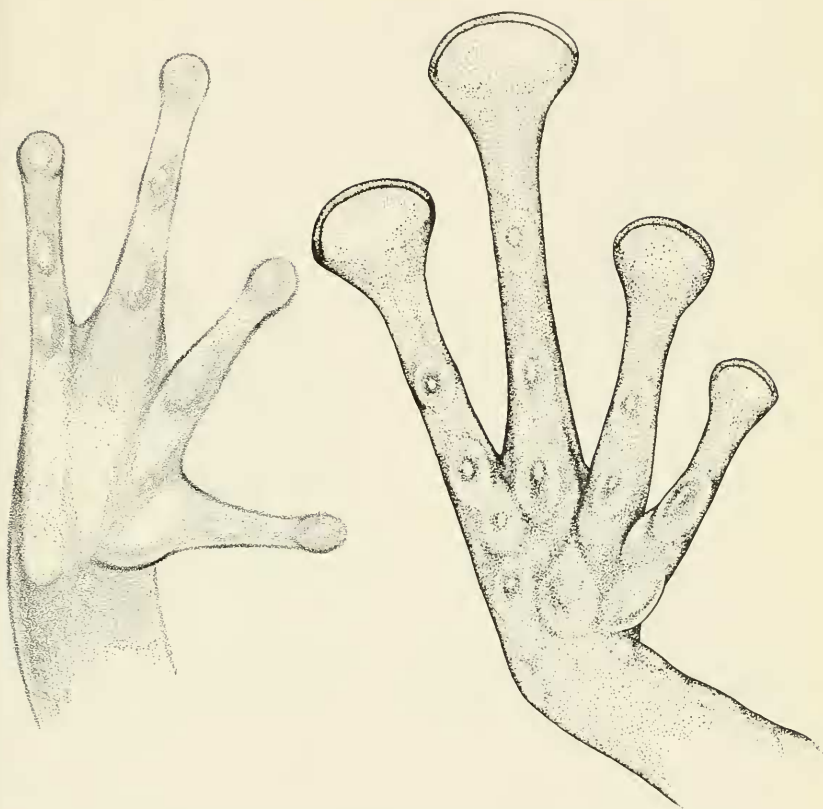


FIG. 1. (to contrast large disked and small disked species) Left: *Batrachyloides trossulus*, inferior view of hand. Right: *B. gigas*, inferior view of hand.

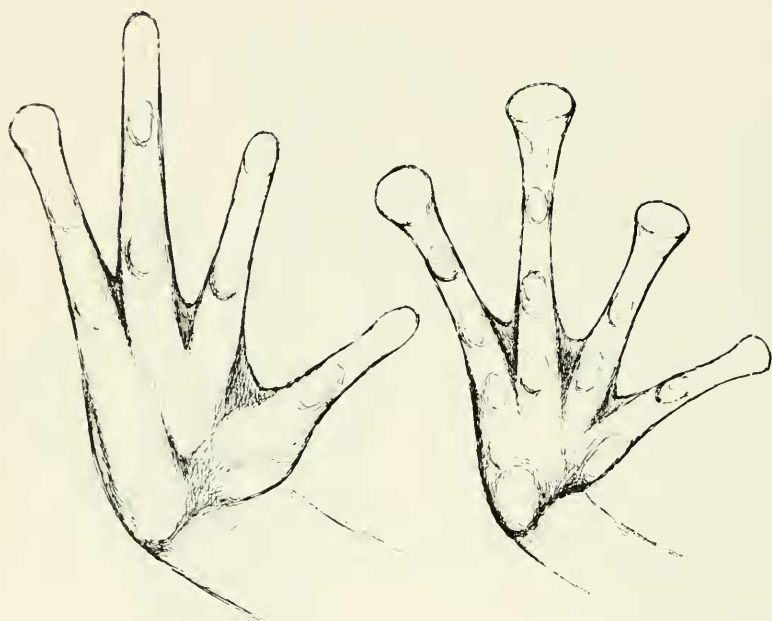


FIG. 2. Left: *Batrochylodes minutus*, inferior view of hand. Right: *B. mediodiscus*, inferior view of hand.

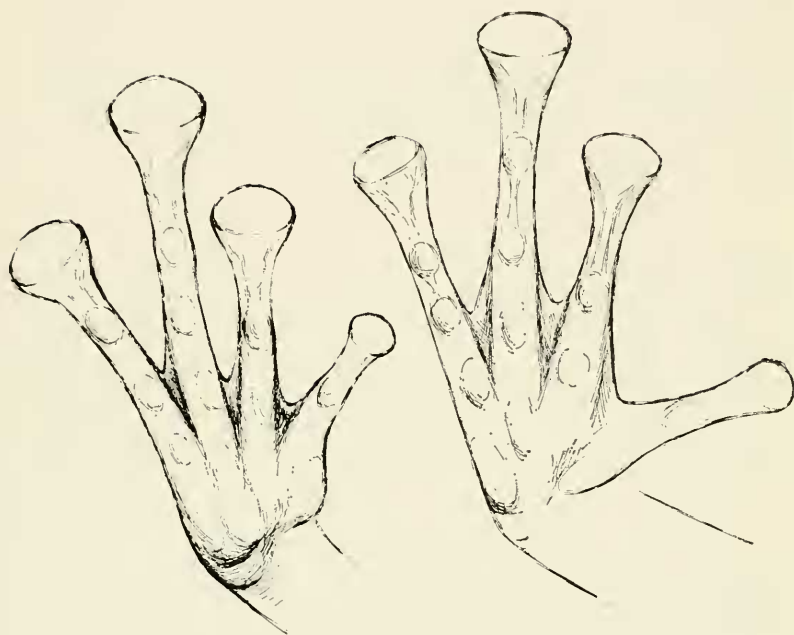


FIG. 3. Left: *Batrachylodes wolfi*, inferior view of hand. Right: *B. vertebralis*, inferior view of hand.